

## **Historic, Archive Document**

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Several hundred trees can be killed in infestation centers (fig. 1), and the loss of trees 3 inches (7.6 cm) in diameter at breast height and larger usually averages above 90 percent. Although pole-size trees are preferred, sawtimber-size trees can also be killed. Topkilling of trees of all size classes frequently occurs.

### Host

In the United States, the beetle principally attacks ponderosa pine, but infestations in Chihuahua pine (*Pinus leiophylla* Schiede and Deppe) have been recorded in the Chiricahua Mountains in southeastern Arizona.

There are reports that this beetle has been collected from several species of pines in Mexico, Guatemala, and Honduras. Its economic importance in these countries is unknown.

### Evidence of Infestation

Pines infested by the Arizona five-spined ips can be distinguished by their fading foliage. Within a few weeks after attack, needles in the top of the crown change to a light straw color (fig. 2). The fading progresses until all foliage on the tree becomes yellow or yellowish-brown. Further evidence of attack is the presence of tan to reddish-brown boring dust in



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Figure 1.—Ponderosa pine trees killed by Arizona five-spined ips.





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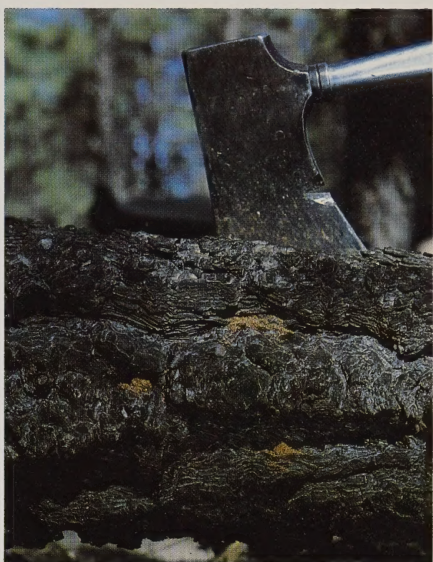
Figure 2.—Attacked trees die from the top down.

bark crevices and at the tree base. Mounds of boring dust can be found on the upper surface of slash infested by the insect (fig. 3).

Not all trees with the symptoms mentioned above are infested only by *Ips lecontei*. *Ips pini* (Say), *Ips knausi* Swaine, *Ips integer* (Eichhoff), and other bark beetle species attack ponderosa pine, although they are not as aggressive as the Arizona five-spined ips in killing live trees.

### Life Cycle

Young adults of the Arizona five-spined ips are light brown, but darken to black as they mature (see cover photo). They are about 5 mm long and have five small spines on each side of the posterior end of the wing covers. Thoracic legs are also present. Adult females lay white, oval eggs (0.5 to 1.0 mm long) that are



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Figure 3.—Boring dust produced by beetles attacking a recently felled tree.

barely visible to the naked eye. The eggs hatch into grublike, legless larvae (fig. 4) that when fully grown transform into pupae. The pupae are white, about 5 mm long, and have many adult characteristics, such as antennae and wing covers.

Generally, this insect goes through three complete generations in a year. Adult beetles, which have overwintered under the bark of infested trees or in slash, emerge when warm weather arrives in April or May and search for a favorable oviposition site. They prefer to attack freshly cut slash, but live trees can be attacked when many beetles are present. By early July, adults produced by the overwintering generation emerge and initiate a second generation that completes development in about a month, because warm July temperatures favor development. Another adult flight occurs, and a third generation begins in mid-August.





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Figure 4.—Arizona five-spined ips larvae.

Beetles from this generation usually remain under the bark until the following spring.

The male beetle initiates the attack on a tree by boring through the bark and forming a nuptial chamber. One to five females (usually three) bore through the bark and join the male. Each fertilized female then constructs an egg gallery up to 25 inches long that is kept free of frass. The eggs are laid on each side of the galleries. In the summer, they hatch in about 1 week. As they feed on the inner bark,

the larvae construct feeding galleries perpendicular to the egg gallery. After larvae complete their growth, they form pupal chambers between the inner and outer bark, transform into pupae, and then transform into adults. The adults bore out of the tree and begin another generation.

#### **Natural Control**

Several biotic and abiotic factors help to hold low-level populations of the beetle in check, but they cannot be relied upon to halt outbreaks.

Several species of small wasps parasitize this ips, and predaceous beetles feed on both mature and immature stages. Internal nematode parasites reduce the egg-laying potential of infested females by as much as 50 percent. Winter temperatures of  $-5^{\circ}\text{F}$  ( $-21^{\circ}\text{C}$ ) and lower for a period of a few days can cause extensive beetle mortality.

### **Integrated Pest Management**

Beetle-caused tree damage can be substantially reduced through the use of one or more prevention and suppression techniques.

**Prevention.**—The number and combination of prevention methods needed in a management area must be evaluated in relation to the risk of an outbreak occurring. At a minimum, slash should not be created for two or more consecutive seasons in ponderosa pine stands growing at low elevations in central and southern Arizona. Additional techniques may be needed during drought periods, or where trees have been weakened by defoliating insects, tree diseases, fire, or other causes.

The season when trees are cut greatly influences the production of beetles in future generations. Trees cut from July to December dry out during the fall and winter months and are unsuitable for beetle habitat. It is best to cut trees in late summer to permit trees to dry for as long a period as possible.

Harvesting most pines to a diameter of 4 inches (10.2 cm) will prevent beetle population increases. Few beetles are produced in pine slash or in trees less than 4 inches

(10.2 cm) in diameter because of the limited amount of food reserve in the inner bark.

Any means of destroying green slash—burning, chipping, burying, or other practices—will remove the conditions favoring beetle buildups.

**Suppression.**—After slash or weakened trees are infested by the Arizona five-spined ips, suppression can be achieved by treating the infested material. The decision to conduct a suppression program is difficult because there is no reliable way to determine if beetles will attack live trees in a management unit, fly elsewhere and attack trees, or decline without causing any significant tree damage. Also, infestations must be detected early to allow adequate time to carry out an on-the-ground treatment project. Too often, infestations are not detected until trees begin to fade; it is then too late to take effective action.

A beetle brood in infested material 4 inches (10.2 cm) in diameter and larger can be killed by piling bolts in forest openings, covering piles with clear plastic, and securely anchoring the plastic to the ground. The plastic covering functions like a greenhouse, and temperatures reach a level high enough to kill a brood.

Burning, chipping, debarking, or burying infested slash will also kill a brood.

Moving infested slash 3 or more miles away from ponderosa pine stands prevents emerging beetles from infesting the preferred host.

Finally, lindane products are registered for bark beetle suppression, and broods can be killed by applying the insecticide to the outer bark of material 4 inches (10.2 cm) in



diameter and larger. Carcocylic acid and carboryl are also registered for use.

Entomological and pesticide registration and use information can be obtained by contacting specialists in the following organizations:

USDA Forest Service  
Forest Insect and Disease Management  
517 Gold Avenue, S.W.  
Albuquerque, NM 87102  
Telephone: Commercial (505)  
766-2440; FTS 474-2440

Arizona State Land Department  
Division of Forestry  
1624 West Adams  
Phoenix, AZ 85007  
Telephone: (602) 255-4633

New Mexico Department of Agriculture  
P.O. Box 6  
Albuquerque, NM 87102  
Telephone: (505) 766-3914

New Mexico Department of Natural Resources  
Division of Forestry  
P.O. Box 2167  
Sante Fe, NM 87503  
Telephone: (505) 827-2312

Similar information can be obtained by writing your local college or university.

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Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

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**NOTE:** Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

